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Bo Huang

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EXAMINER

KANG, INSUN

ART UNIT

PAPER NUMBER

2193

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	<b>Application No.</b> 10/813,764	<b>Applicant(s)</b> HUANG ET AL.	
	<b>Examiner</b> INSUN KANG	<b>Art Unit</b> 2193	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 10 October 2008.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 6-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 6-20 is/are rejected.
- 7) ☒ Claim(s) 8, 13 and 18 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)            | 4) <input type="checkbox"/> Interview Summary (PTO-413)           |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | Paper No(s)/Mail Date. _____                                      |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>10/10/2008</u> .  | 6) <input type="checkbox"/> Other: _____                          |

### **DETAILED ACTION**

1. This action is in response to the RCE amendment filed on 10/10/2008.
2. Claims 6-20 are pending in the application.

#### ***Claim Rejections - 35 USC § 112***

3. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

4. Claims 6-20 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Per claims 8, 13, and 18, the specification recites assigning the register class assignment map at a block entry and exit for an arbitrary basic block but the specification does not describe determining the register class assignment map at an entry and exit of an instruction in a block. Per claims 6, 11, and 16, the specification states assigning a register class based on a linear conjunctive forward dataflow analysis. There is no description of assigning the class based at least in part on the analysis. Per claims 7, 9, 10, 12, 14, 15, 17, 19, and 20 are rejected based on the dependency on the parent claims.

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

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6. Claims 6-20 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Per claims 6, 11, 16, the limitation, moving register class fixups, is unclear.

Interpretation: moving register class fixups to a different location.

Per claims 8, 13, and 18, it is unclear how the limitations in claims 8, 13, and 18 are related to and further limit claims 6, 11, and 16. Specifically, it is unclear if the first register class assignment map and the second one refer to the same map. To what block entry/exit of a compilation unit in the independent claims they are referring? It is unclear how the at least one instruction in claims 6, 11, and 16 are related to the block entry/exit of a compilation unit and an entry/exit of an instruction in a block in claim 8, 13, and 18. The instruction in claims 8, 13, and 18 refers to the at least one instruction in claims 6, 11, and 16? Interpretation: marking a register class assignment map that operates to track register class assignments at a block entry and exit of the at least one instruction.

Per claim 9 (line 2), 14 (line 3), and 19 (line 3), "hoisting register class fixups" is interpreted as: hoisting the register class fixups.

Per claims 10, 12, 15, 17, and 20 are rejected based on the dependency on the parent claims.

### ***Claim Objections***

7. Claims 8, 13, and 18 are objected to because of the following informalities: "a instruction" needs to be changed to "an instruction." Appropriate correction is required.

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***Claim Rejections - 35 USC § 103***

8. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

9. Claims 6-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hopkins et al. (US Patent 4,961,141) hereafter referred to as “Hopkins” in view of Esparza et al. ("Efficient algorithms for pre\* and post\* on interprocedural parallel flow graphs," ACM, 2000) hereafter Esparza.

Per claim 6:

Hopkins discloses:

- assigning a first register class to at least one symbolic register in at least one instruction (i.e. “for each equivalence class, forming the logical OR function of register usage information for all symbolic registers in the class,” col. 1 lines 55-60; “initializing in function block 27...i is set equal to the first register,” col. 4 lines 21-34)
- assigning a second register class to the at least one symbolic register (i.e. after step 34 in Fig 4, i+1 is set back to FIRST REG which assigns the i+1 to the symbolic register);

Hopkins does not explicitly teach linear conjunctive forward dataflow analysis that iterates each basic block of instructions only once. However, Esparza teaches it was

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known in the pertinent art, at the time applicant's invention was made, to achieve dataflow analysis with reduction clauses by conjunctive forward analysis in linear time (i.e. abstract; page 8, right col. third paragraph) . It would have been obvious for one having ordinary skill in the art to modify Hopkins' disclosed system to incorporate the teachings of Esparza. The modification would be obvious because one having ordinary skill in the art would be motivated to reduce the register assignment sets by assigning a register class only if the conjunctive clause is true in linear time.

Hopkins further discloses:

- moving existing register class fixups for the assignment of the second register class (i.e. "dead code in the program is removed in block 6," col. 2 lines 50-60; "fix up code is inserted...move the value from one space to another," col. 3 lines 33-44);
- removing unnecessary register class fixups, the moving and removing to reduce the register class fixups, wherein register class fixups are instructions inserted into a program in response to one or more register class assignment modifications(i.e. "dead code in the program is removed in block 6," col. 2 lines 50-60; col. 3 lines 33-49)
- renaming the at least one symbolic register (i.e. "If so, new names are made up in function block 39 so that there is a different name for each context," col. 4 lines 41-44).
- Wherein each instruction includes assignment of one of the first register class assigned and the second register class assigned (i.e. after step 34 in Fig 4, i+1 is set back to FIRST REG which assigns the i+1 to the symbolic register).

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Per claim 7:

Hopkins further discloses:

- said assigning the first register class is an initial assignment (i.e. “SET i = FIRST REG,” Fig 4A).

Per claim 8:

Hopkins further discloses:

- marking a register class assignment map that operates to track register class assignments at a block entry of a compilation unit (i.e. “i is set equal to the first register,” which is a block entry initializing the function block; col. 4 lines 21-25; see also Fig 4 the loop block);
- marking the register class assignment map at a block exit of compilation unit (i.e. see Fig 4, in function block 34, i is indexed by adding one to i before looping back to decision block 28; “in the decision block 25, a test is made to determine if there are any more operations to be processed...otherwise, control passes to the interlude logic,” which sets i to N (exit point) after the final loop, col. 4 lines 15-19)
- determining the register class assignment map at an entry of each instruction in a block(i.e. ; “a test is made in decision block 28 to determine if i is less than or equal to the last register,” col. 4 lines 21-34; the decision blocks 28 and 29 are performed at an entry point i)
- determining the register class assignment map at an exit of each instruction in the block (i.e. ; “a test is made in decision block 28 to determine if i is less than or equal

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to the last register,” col. 4 lines 21-34; the decision blocks 28 and 29 are performed at an exit point where i is set to N (exit point) after the final loop).

Per claim 9:

Hopkins further discloses:

- one or more of hoisting and sinking the register class fixups (i.e. “fix up code is inserted...move the value from one space to another,” col. 3 lines 33-44);

Per claim 10:

Hopkins further discloses:

- removing dead code (i.e. “dead code in the program is removed in block 6,” col. 2 lines 50-60).

Per claims 11-15, they are the system versions of claims 6-10, respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 6-10 above.

Per claims 16-20, they are the computer versions of claims 6-10, respectively, and are rejected for the same reasons set forth in connection with the rejection of claims 6-10 above.

### ***Response to Arguments***

10. Applicant's arguments filed on 10/10/2008 have been fully considered but they are not persuasive.



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The applicant states that Hopkins discloses inserting fix up code and not moving fix up code that has already been inserted. In contrast, applicant's claims recite moving fixups that has already been inserted (remark, 8).

In response, the instant specification describes that the register class fixups are reduced through code hoisting/sinking and dead code elimination (0037) and claim 10 recites that the removing the register class fixups that are unnecessary comprises removing dead code. In Hopkins, the fix up code is inserted and then the dead code elimination optimization on the code including the fixup code is performed to remove dead code (col. 3 lines 33-49).

***Response to Amendment***

11. The specification filed on 10/10/2008 is non-responsive because the reintroduced limitations are not underlined and the previously added limitation is underlined. The non-responsiveness needs to be corrected.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to INSUN KANG whose telephone number is (571)272-3724. The examiner can normally be reached on M-R 7:30-6 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Lewis A. Bullock, Jr. can be reached on 571-272-3759. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Insun Kang/  
Examiner, Art Unit 2193